CLAIMS:

What is claimed is:

1. A plasma processing system for etching a layer on a substrate comprising:

a process chamber;

a diagnostic system coupled to said process chamber and configured to measure at least one endpoint signal; and

a controller coupled to said diagnostic system and configured to determine at least one of an etch rate and an etch rate uniformity of an etching process in said processing chamber from said at least one endpoint signal and a thickness of said layer, wherein said thickness comprises at least one of a minimum thickness, a maximum thickness, a mean thickness, and a thickness range.

2. The plasma processing system as recited in claim 1, wherein said diagnostic system comprises at least one of an optical diagnostic subsystem and an electrical diagnostic subsystem.

3. The plasma processing system as recited in claim 2, wherein said optical diagnostic subsystem comprises at least one of a detector, an optical filter, a grating, and a prism.

4. The plasma processing system as recited in claim 2, wherein said optical diagnostic subsystem comprises at least one of a spectrometer and a monochromator.

5. The plasma processing system as recited in claim 2, wherein said electrical diagnostic subsystem comprises at least one of a voltage probe, a current probe, a spectrum analyzer, an external RF antenna, a power meter, and a capacitor setting monitor.

6. The plasma processing system as recited in claim 1, wherein said at least one endpoint signal comprises an endpoint transition.

7. The plasma processing system as recited in claim 6, wherein said endpoint transition comprises a starting time, an end time, and an inflection time.

8. The plasma processing system as recited in claim 7, wherein said etch rate is determined from a ratio of said minimum thickness of said layer to said starting time of said endpoint transition.

9. The plasma processing system as recited in claim 7, wherein said etch rate is determined from a ratio of said maximum thickness of said layer to said end time of said endpoint transition.

10. The plasma processing system as recited in claim 7, wherein said etch rate is determined from a ratio of said mean thickness of said layer to said inflection time of said endpoint transition.

11. The plasma processing system as recited in claim 8, wherein said etch rate uniformity ΔE is determined from $\Delta E = \frac{E}{T_{\max}}(E\Delta t - \Delta T)$ where T_{max} is said maximum thickness, ΔT is said thickness range, Δt is the time difference between said start time and said end time, and E is said etch rate.

12. The plasma processing system as recited in claim 1, wherein a ratio signal is determined from a ratio of a first endpoint signal to a second endpoint signal.

13. The plasma processing system as recited in claim 12, wherein said ratio signal comprises an endpoint transition.

14. The plasma processing system as recited in claim 13, wherein said endpoint transition comprises a starting time, an end time, and an inflection time.

15. The plasma processing system as recited in claim 14, wherein said etch rate is determined from a ratio of said minimum thickness of said layer to said starting time of said endpoint transition in said ratio signal.

16. The plasma processing system as recited in claim 14, wherein said etch rate is determined from a ratio of said maximum thickness of said layer to said end time of said endpoint transition in said ratio signal.

17. The plasma processing system as recited in claim 14, wherein said etch rate is determined from a ratio of said mean thickness of said layer to said inflection time of said endpoint transition in said ratio signal.

18. The plasma processing system as recited in claim 1, wherein said at least one endpoint signal is related to a spectral irradiance of emitted light from said plasma processing system.

19. The plasma processing system as recited in claim 1, wherein said at least one endpoint signal is filtered.

20. An in-situ method of determining an etch property for etching a layer on a substrate in a plasma processing system comprising:

providing a thickness of said layer, wherein said thickness comprises at least one of a minimum thickness, a maximum thickness, a mean thickness, and a thickness range;

etching said layer on said substrate;

measuring at least one endpoint signal using a diagnostic system coupled to said plasma processing system, wherein said at least one endpoint signal comprises an endpoint transition; and

determining said etch rate from a ratio of said thickness to a difference between a time during said endpoint transition and a starting time of said etching.

21. The method as recited in claim 20, wherein said diagnostic system comprises at least one of an optical diagnostic subsystem and an electrical diagnostic subsystem.

22. The method as recited in claim 21, wherein said optical diagnostic subsystem comprises at least one of a detector, an optical filter, a grating, and a prism.

23. The method as recited in claim 21, wherein said optical diagnostic subsystem comprises at least one of a spectrometer and a monochromator.

24. The method as recited in claim 21, wherein said electrical diagnostic subsystem comprises at least one of a voltage probe, a current probe, an external RF antenna, a power meter, a spectrum analyzer, and a capacitor setting monitor.

25. The method as recited in claim 20, wherein said endpoint transition comprises a starting time, an end time, and an inflection time.

26. The method as recited in claim 25, wherein said thickness is said minimum thickness of said layer and said time is said starting time of said endpoint transition.

27. The method as recited in claim 25, wherein said etch rate is determined from a ratio of said maximum thickness of said layer to said end time of said endpoint transition in one of said at least one endpoint signals.

28. The method as recited in claim 25, wherein said etch rate is determined from a ratio of said mean thickness of said layer to said inflection time of said endpoint transition in one of said at least one endpoint signals.

29. The method as recited in claim 20, wherein said at least one endpoint signal comprises two endpoint signals.

30. The method as recited in claim 29, wherein a ratio signal is determined from a ratio of a first endpoint signal of said two endpoint signals to a second endpoint signal of said two endpoint signals.

31. The method as recited in claim 30, wherein said ratio signal comprises an endpoint transition.

32. The method as recited in claim 31, wherein said endpoint transition comprises a starting time, an end time, and an inflection time.

33. The method as recited in claim 32, wherein said etch rate is determined from a ratio of said minimum thickness of said layer to said starting time of said endpoint transition in said ratio signal.

34. The method as recited in claim 32, wherein said etch rate is determined from a ratio of said maximum thickness of said layer to said end time of said endpoint transition in said ratio signal.

35. The method as recited in claim 32, wherein said etch rate is determined from a ratio of said mean thickness of said layer to said inflection time of said endpoint transition in said ratio signal.

36. The method as recited in claim 20, wherein said at least one endpoint signal is related to a spectral irradiance of emitted light from said plasma processing system.

37. The method as recited in claim 20, wherein said at least one endpoint signal is filtered.

38. The method as recited in claim 20, wherein said method further comprises determining a time duration for said endpoint transition of said at least one endpoint signal.

39. The method as recited in claim 38, wherein said method further comprises determining an etch rate uniformity from said etch rate, said time duration of said endpoint transition, and said thickness range of said layer.

40. The method as recited in claim 31, wherein said method further comprises determining a time duration for said endpoint transition of said ratio signal.

41. The method as recited in claim 40, wherein said method further comprises determining an etch rate uniformity from said etch rate, said time duration of said endpoint transition, and said thickness range of said layer.

42. The plasma processing system as recited in claim 9, wherein said etch rate uniformity ΔE is determined from $\Delta E = \frac{E}{T_{\max}}(E\Delta t - \Delta T)$ where T_{max} is said maximum thickness, ΔT is said thickness range, Δt is the time difference between said start time and said end time, and E is said etch rate.

43. The plasma processing system as recited in claim 10, wherein said etch rate uniformity ΔE is determined from $\Delta E = \frac{E}{T_{\max}}(E\Delta t - \Delta T)$ where T_{max} is said maximum thickness, ΔT is said thickness range, Δt is the time difference between said start time and said end time, and E is said etch rate.